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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/694,172	10/28/2003	Kazuyoshi Ueno	Q78176	2754
23373	7590	11/27/2006	EXAMINER	
SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037			TSOY, ELENA	
			ART UNIT	PAPER NUMBER
			1762	

DATE MAILED: 11/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/694,172

Applicant(s)

UENO ET AL.

Examiner

Elena Tsoy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 28 October 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) 1-6 and 12-17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 7-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All   b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)                      4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)                      5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 10/03,2/05                      6) ☐ Other: \_\_\_\_\_

***Election/Restrictions***

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-6, and 12-17, drawn to Ultra-Large Scale Integrated (ULSI) wiring, classified in class 428, subclass 209.
- II. Claims 7-11, drawn to Ultra-Large Scale Integrated (ULSI) wiring, classified in class 428, subclass 209.

***Distinctness***

The inventions are distinct, each from the other because:

Inventions I and II are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects because a second insulating layer in ULSI wiring of invention I is applied over a capping layer, whereas a second insulating layer in ULSI wiring of invention II is applied over a wiring layer.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

During a telephone conversation with Carl J. Pellegrini on November 17 a provisional election was made without traverse to prosecute the invention of Group II, claims 7-11.

Affirmation of this election must be made by applicant in replying to this Office action. Claims

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1-6, and 12-17 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

### *Specification*

1. A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required. The substitute specification filed must be accompanied by a statement that it contains no new matter.
2. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: Claim 8 recites limitation “wherein said diffusion prevention layer contains at least one of silicon and carbon” which is not in the body of the disclosure. Amendment of the disclosure to incorporate the language of originally filed claims does not raise issue of new matter.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claims 7-11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 7 recites a phrase “trench and via formed on the surface of the first insulating layer”, which renders the claim indefinite because it is not clear how trench and via formed **on the surface** of the first insulating layer. For examining purposes the phrase was interpreted as “trench and via formed ~~on the surface of~~ in the first insulating layer”.

#### *Claim Objections*

5. Claim 8 is objected to because of the following informalities: even though abbreviation "ULSI" is well known in the art, the Examiner recommends to recite a spelled version in addition to the abbreviated term to make the claim more clear, for example, as “ Ultra-Large Scale Integrated, ULSI, wiring”.

6. Claim 5 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claims 1 and 5 recite the same limitation “the wiring layer is separately formed via a diffusion prevention layer with the first insulating layer”.

7. Claim 8 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 8 recites “wherein said diffusion prevention layer contains at least one of silicon and carbon” whereas claim 7, on which claim 8 depends, recites that the diffusion prevention layer is formed from a plating film selected from the group consisting of a nickel-tungsten-phosphorus plating film, a nickel-rhenium-phosphorus plating film, a nickel-boron film, a cobalt-tungsten-phosphorus film, a cobalt-tungsten-boron film, and a cobalt metal

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film. In other words, dependent claim 8 recites a diffusion prevention material which is NOT related to the diffusion prevention material of independent claim 7. For examining purposes a material containing silicon and carbon was interpreted as a material of an adhesion layer.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al (US 6180523).

Lee et al disclose Ultra-Large Scale Integrated (ULSI) wiring (See Abstract) comprising a first insulating interlayer 20 having at least one of trench and via formed in the first insulating layer 20 of e.g. silicon dioxide (See column 12, lines 17-18), a first barrier layer 34 (claimed diffusion prevention layer) on the adhesion layer 28 formed on side walls of the at least one of trench and via and on a bottom of a substrate 10 of silicon dioxide (See column 2, lines 59-60), a wiring layer 38 formed in the space of the first barrier layer 34, and a second insulating layer 42 covered over at least the wiring layer, wherein the first barrier layer 34 is made of a *plating* film selected from the group consisting of Ni, Pd, Co or alloys of Ni, Pd, Co, but not limited to these (See Fig. 6; column 8, lines 50-59; column 10, lines 20-23). Lee et al teach that the adhesion layer is preferably composed of Al or Al alloys, polysilicon, Ni, titanium or amorphous silicon (See column 8, lines 15-17). Lee et al further teach that a second barrier layer 46 may be formed

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on the wiring layer 38 by electroless *plating*, wherein the second barrier layer 46 is made of a nickel-boron, Pd or Co or Cu, Au, most preferably of Ni-B to reduce the resistivity (See Fig. 8; column 10, lines 36-37).

Lee et al do not expressly teach that the first barrier layer 34 (claimed diffusion prevention layer) may also be made of nickel-boron. However, since Lee et al teach that the first barrier layer 34 is not *limited* to Ni, Pd, Co, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have made the first barrier layer 34 of nickel-boron instead of Pd or Co with the expectation of providing the desired reduced resistivity depending on particular use of a final product.

10. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al in view of Neary (US 4424805) and Vullaume et al (Applied Physics Letters, vol. 69, pages 1646-1648, 1996) described by Wada et al (US 20050056828).

The Examiner Note: the Examiner will refer to Wada et al (US 20050056828) for description of Vullaume et al.

Lee et al are applied here for the same reasons as above. Lee et al fail to teach that an adhesion layer between said first insulating layer and said diffusion prevention layer contains at least one of silicon and carbon (Claims 7-8); the adhesion layer is substantially made of silane compound layer (Claim 10) such as a monomolecular layer of a silane compound layer containing an amino group (Claim 11).

Neary teaches that organo silicon monomers which characteristically possess two or more different types of chemical functionality can be used for bonding *dissimilar* materials (See

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column 5, lines 50-55). For example, silanes may be used for bonding silicon oxide surface by reacting silanol moiety with the surface oxide thus leaving organic functional group, R, extended away from the surface (See column 6, lines 6-19). When R is **amino** group, silane can be bonded to metal surfaces by complexation, coordination or chelation (See column 6, lines 25-30).

Therefore, it would be obvious to one of ordinary skill in the art to use amino group containing silane to bond silicon oxide with metal.

Vullaume et al teach that a monomolecular layer of a silane coupling agent functions as a gate insulating film (for example, makes the leakage current satisfactorily small): the leakage current in the monomolecular layer of the silane coupling agent is smaller by 4 to 5 digits than that in silicon oxide having the same thickness (See US 20050056828 to Wada et al, P205).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a monomolecular layer of amino group containing silane coupling agent in Lee et al instead of adhesive with the expectation of providing the desired bonding of silicon oxide with metal and the desired satisfactorily small leakage current, as taught by Neary and Vullaume et al.

### ***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy whose telephone number is 571-272-1429. The examiner can normally be reached on Monday-Thursday, 9:00AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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November 21, 2006